SCIENCE
10 November 1967
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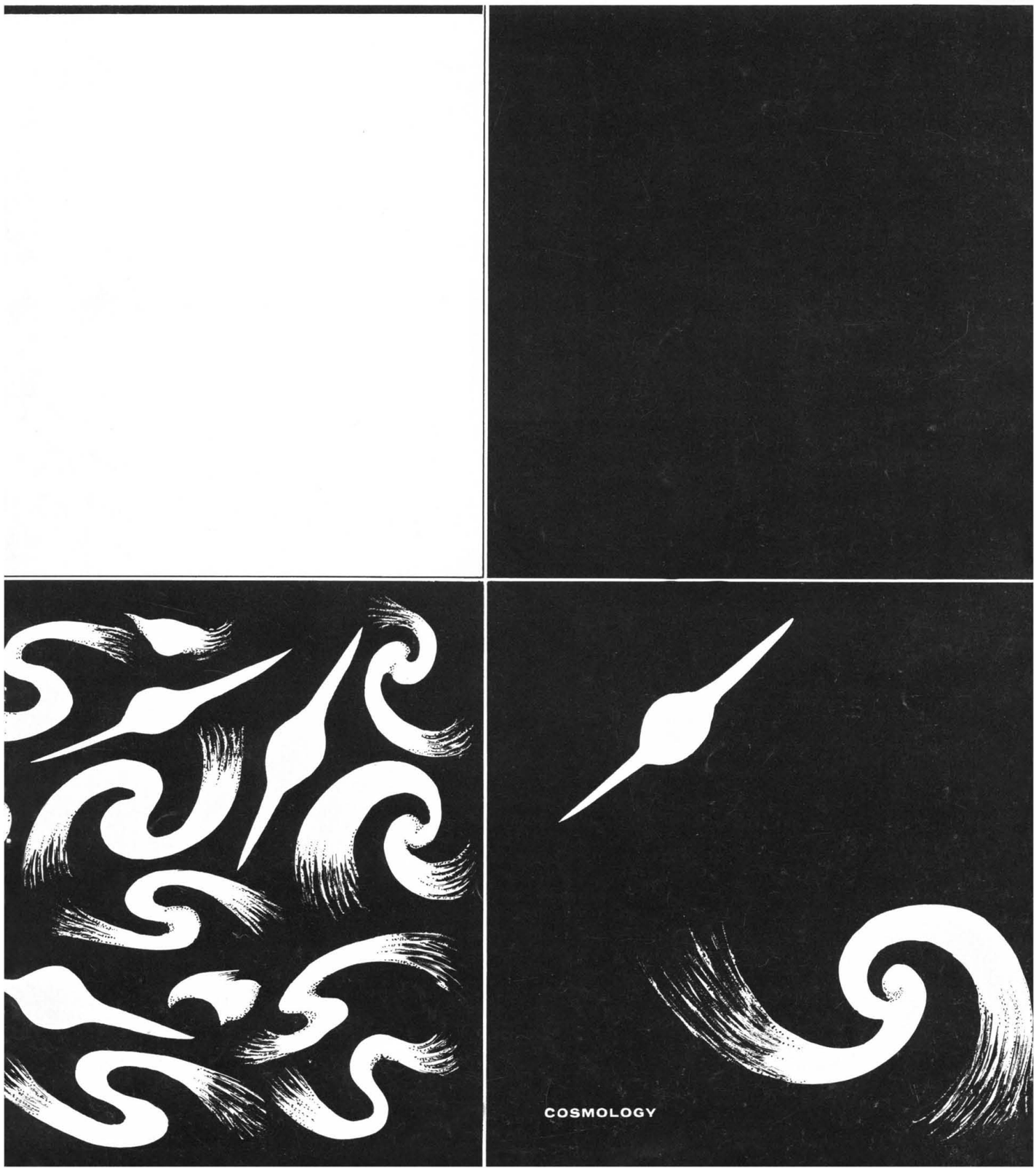
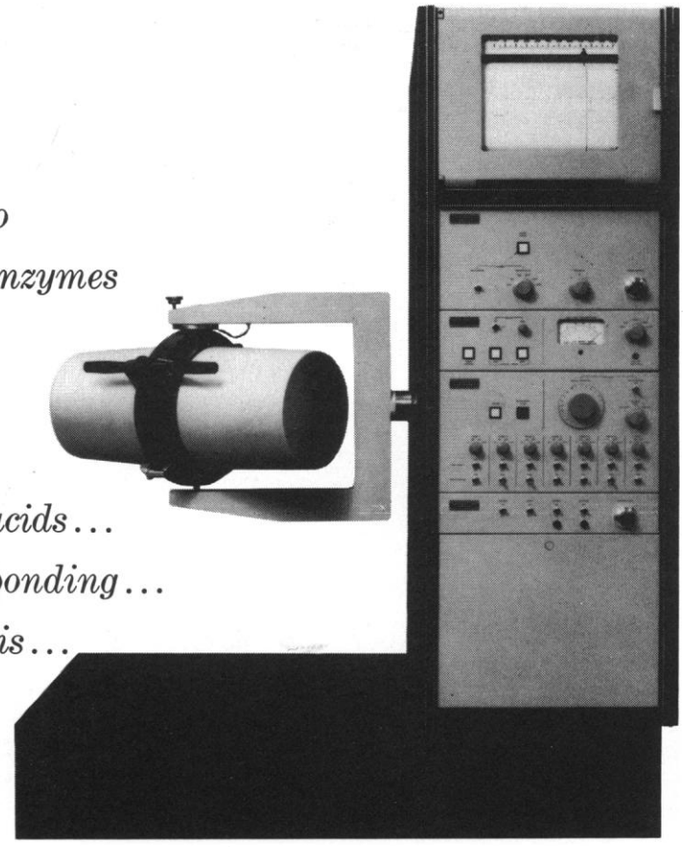
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



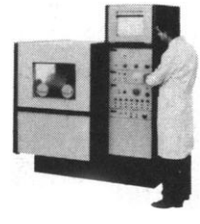
For a new insight into
interactions between enzymes
and substrates...
antigen-antibody
interactions... helix
formation of nucleic acids...
ATP hydrolysis and bonding...
bacterial thermogenesis...
solution...
dilution... effects
at interfaces...



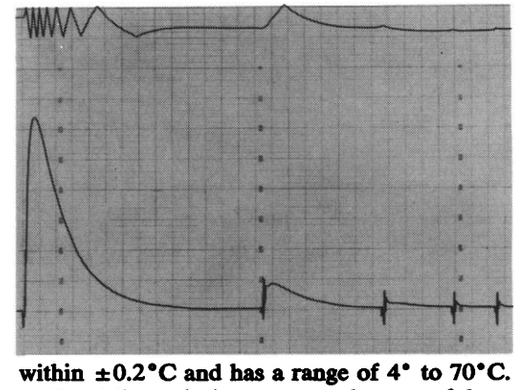
a new tool for the biochemist

Until recently only a handful of investigators have been able to study heats of reaction in biochemical systems. The Spinco Division of Beckman Instruments is now happy to make available to the biochemist an instrument which makes such micro-measurements of heat practical: the Model 190B Microcalorimeter. It is designed to serve a fundamental area of investigation, one that has tremendous potential and that has been virtually unexplored.

The Model 190B Microcalorimeter measures thermal flux in solutions; it is sensitive to temperatures in the microdegree range and permits the use of samples and solutions in the micromolar range. Heats of reaction in the order of 5 millicalories can be detected and recorded with an accuracy of ±3%.



An environmental temperature enclosure, shown on the Model 190B at right, maintains operating temperature of the instrument to within ±0.2°C and has a range of 4° to 70°C.



The Microcalorimeter records rate of heat flow in microcalories per second with time. A representative trace is shown above. It reflects heats of reaction from aldolase cleavage of fructose-1,6-diphosphate. Integration trace, top, facilitates calculation. For additional information on the Beckman Microcalorimeter, write for Data File 190-5.

Beckman INSTRUMENTS, INC.
SPINCO DIVISION
PALO ALTO, CALIFORNIA • 94304

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Now—control spill-over in dual label scintillation counting automatically.

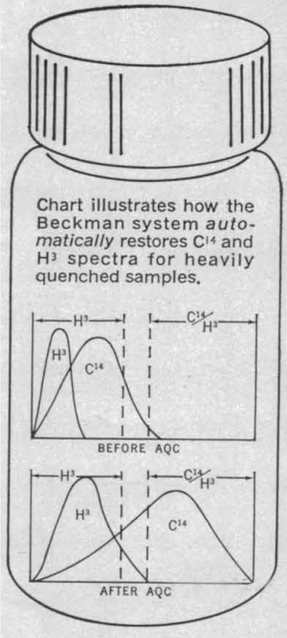

Chart illustrates how the Beckman system *automatically* restores C^{14} and H^3 spectra for heavily quenched samples.

Beckman introduces Automatic Quench Calibration (AQC) – an exclusive capability which permits each isotope to be counted in its optimum window regardless of quench level – automatically.

With the problem of spill-over between channels brought under precise control, double-label experiments under varying quench conditions are practical for the first time. Available now on our LS-150 and LS-250 Counters, AQC automatically compensates for varying quench between samples by adjusting system gain to the optimum setting for each sample before it is counted. It eliminates the laborious task of maintaining a constant quench for all samples. You have *no manual adjustments* to make after initial calibration–the system is completely automatic. Just punch the START button and leave the instrument unattended. Your 100 or 200 sample load will be fully analyzed in significantly faster time–*with guaranteed higher accuracy*–than previously possible. For single isotope analysis with samples of widely varying quench-again, nothing need be touched but the START button to receive optimum counting performance, automatically.

No competing system even approaches the LS-150 and LS-250 in solving the spill-over problem and simplifying other complexities of scintillation counting – for more details and demonstration of their exclusive benefits, contact your Beckman Sales Representative or write for Data File #400E. Automatic Quench Calibration is...

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10 November 1967
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SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Representations of the world's evolution. White box is primeval fireball; black box and box lower left represent cool and dark stage when galaxies begin to form; lower right box indicates dispersal of stellar galaxies. See page 766. [Adapted from George Gamow, by Marshall Kathan, AAAS]

New opportunities in physical and occupational therapy

1. College program for occupational therapy majors. If you want to become a professionally qualified occupational therapist, the Army will start helping in your junior year. You can receive a monthly education subsidy while you complete your undergraduate studies at your present school. Then you'll study at one of the Army's modern hospitals in Washington, San Francisco or San Antonio. There you'll receive clinical training in occupational therapy to fully qualify you for military or civilian practice.

2. Clinical affiliation for occupational therapists. Occupational Therapy Students may be selected for participation in the 36-week Army clinical affiliation. This unique program includes supervised training and experiences second to none. As a second lieutenant, you may accumulate creditable time towards pay and longevity while receiving your training.

3. Physical therapy program for college graduates. The Army offers college graduates one of the finest physical therapy programs in the Nation. As a commissioned officer you will attend the Medical Field Service School at Fort Sam Houston, Texas. After completing this curriculum you will be fully qualified for military or civilian practice.

4. Today's challenge gives therapists valuable new clinical experience. The challenge to professional occupational and physical therapists comes from wounded American soldiers. While serving in the Army Medical Specialist Corps, you can gain valuable professional experience on cases seldom seen in civilian practice. You will work on the finest professional staffs. You will have broad opportunities for continuing education, professional advancement and travel that are designed to meet your professional and personal interests.

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Army

S-5-35

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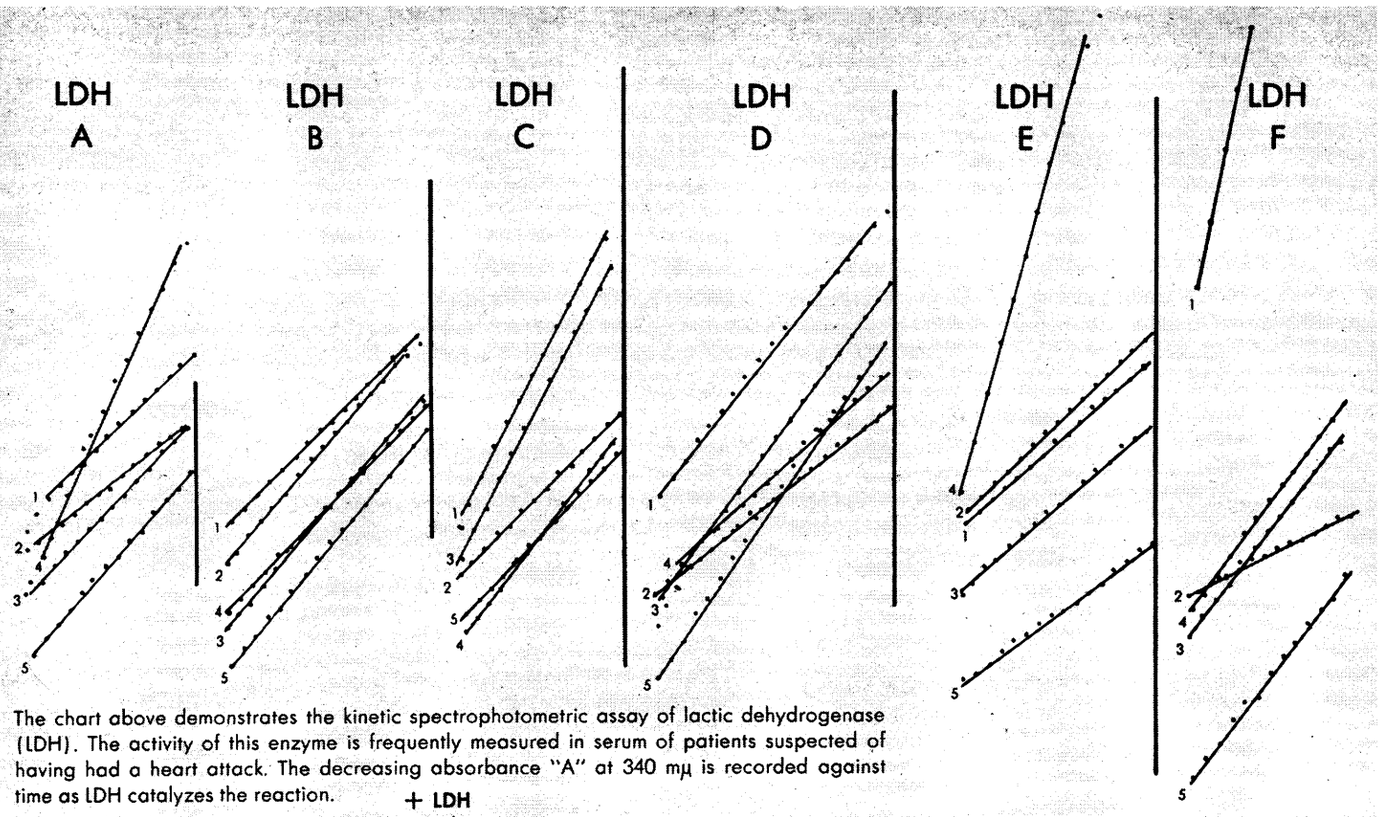
My major is _____.
I expect to graduate in _____.

( ) I am a college graduate.
My major was _____.
I am interested in
( ) occupational therapy.
( ) physical therapy.

( ) I am a qualified physical therapist.
( ) I am a qualified occupational therapist.

Name _____
Address _____
City _____ State _____
Age _____ Zip Code _____



The chart above demonstrates the kinetic spectrophotometric assay of lactic dehydrogenase (LDH). The activity of this enzyme is frequently measured in serum of patients suspected of having had a heart attack. The decreasing absorbance "A" at 340 mμ is recorded against time as LDH catalyzes the reaction.

$$\text{pyruvate} + \text{DPNH} \overset{+\ \text{LDH}}{\rightleftarrows} \text{DPN} + \text{H}^+ + \text{lactate}$$

The rate of this reaction (slope of dA/dt during the initial "O" order portion) is a measure of the enzyme's activity. Extreme slopes and/or deviation from linearity are indicative of an LDH abnormality. 30 production runs in 6 groups are recorded on one chart, at 3 minutes/ group.

NEW AUTOMATIC TECHNIQUE REDUCES ENZYME ANALYSIS COSTS

You can do all of your reaction kinetics experiments on this one instrument, and still have a double-beam, scanning UV-Visible Spectrophotometer for bilirubin, barbiturate and salicylate analyses.

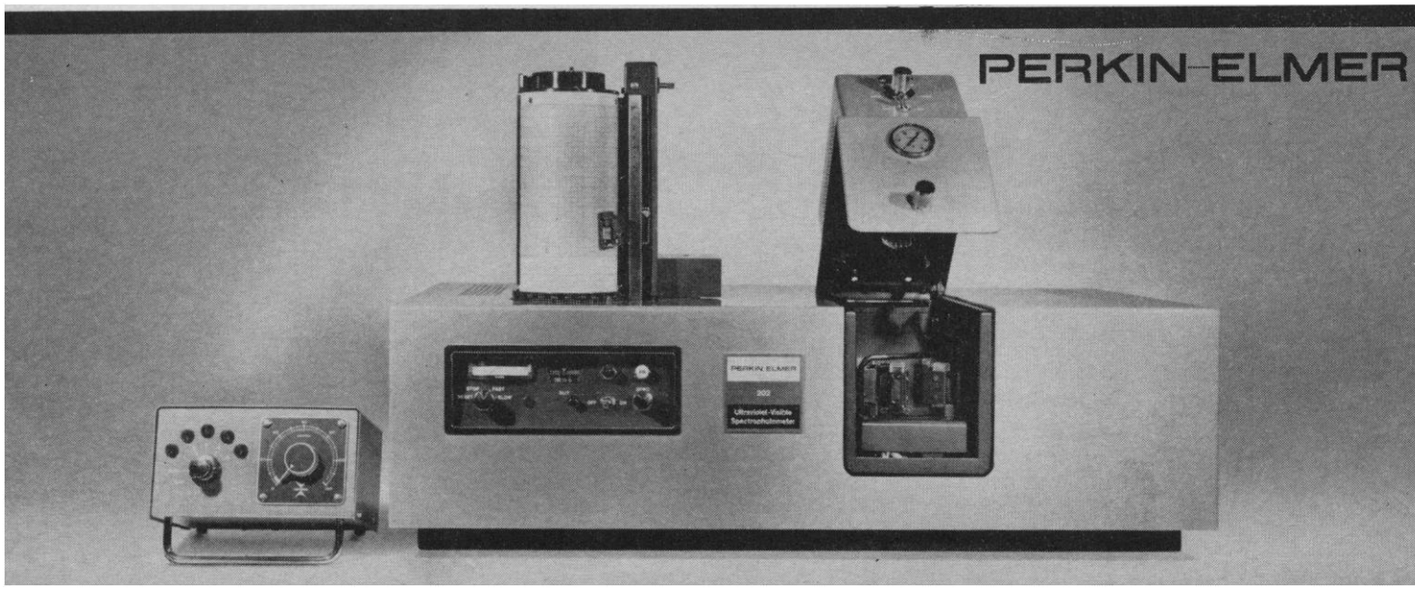
The Automatic Multiple Sampling System using Perkin-Elmer's Model 202 Spectrophotometer, saves you vital laboratory analysis time in clinical serum studies. Kinetic reactions may be studied spectrophotometrically, on a production scale of hundreds of analyses per day, at a minimum cost per analysis.

The analysis proceeds at a fixed wavelength of light. The wavelength you select is held constant while the decrease in absorbance of one of the reactants is recorded as a function of time.

Perkin-Elmer's Automatic Multiple Sampling System features...

- A double beam, direct absorbance recording spectrophotometer with analytical accuracy of ± .01 absorbance units;
- A unique dot readout system that provides, on one chart, a complete continuous record of absorbance as a function of time for a batch of 5 samples plus a separate reference blank;
- A thermostated sample compartment, with temperature control within ± 0.5°C from 20° to 50°C plus automatic sample positioning;
- An adjustable time interval between sample readings of 3 to 120 seconds.

For more information about this new enzyme analysis technique plus details on the Perkin-Elmer Model 202 Spectrophotometer write to: Instrument Division, Perkin-Elmer Corporation, **723** Main Avenue, Norwalk, Connecticut.



This is the revolutionary micropipet with an unbelievably accurate tip and a completely automatic top.

Take the new Eppendorf automatic micropipet in hand and be prepared to have your pipetting habits changed... radically.

For example, you won't have to wash or wipe pipets anymore, or worry about contamination or liquids in your mouth. The Eppendorf holds liquid in disposable plastic tips that are instantly interchangeable and completely separate from the pipet mechanism.

You'll also have to unlearn living with significant pipet error. Unlike glass or ordinary plastic pipet tips which always retain a significant liquid film on their inner surface, the Eppendorf polypropylene tips assure virtually complete sample recovery—over 99% with aqueous solutions, 97% with serum. And look at this precision: at 5 μl, standard deviation is under 0.04 μl, or less than 1%.

But the easiest thing to get used to with the new Eppendorf is the ease and speed of pipetting. Just press the button on top to fill. To empty, press again. That's all. Blowout of the entire sample is automatic and complete.

The Eppendorf is available in models dispensing volumes of 5, 10, 20, 50, 100, 200, 500 and 1,000 μl. It can even be used with acids and organic solvents.

Once you've tried the revolutionary Eppendorf, you'll never want to use conventional micropipets again.

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The *permanent* objective aperture is standard equipment on the RCA Type EMU-4 Microscope and is but one of the many innovations that are "standard" for the *new look in electron microscopes:* transistorized, modularized electronics; an exclusive selected-area diffraction facility; provision for instrument revision and expansion; high-capacity, minimum-backstreaming diffusion pump and many others.

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With RAX time-sharing, up to 63 people use one IBM SYSTEM/360 simultaneously.

RAX (Remote Access Computing System) is a time-sharing program designed for IBM SYSTEM/360 Models 30, 40, 50.

With RAX, the engineer, scientist or programmer—using a remote terminal—processes his problems on the central SYSTEM/360. Up to 62 of his colleagues can do the same thing simultaneously. Each one works without concern for the system's total processing load. Their typewriter consoles or visual display stations return results after a typical wait of only four to five seconds.

At the same time, operators at the computer center can batch process FORTRAN and Basic Assembler Language problems through SYSTEM/360.

The first RAX system was developed at Lockheed Aircraft in Marietta, Ga.

The one-man, one-console idea began to germinate at Lockheed about four years ago. It had become apparent to people like Dr. Warren Herron, Chief of Scientific Computing, that engineers need a highly accessible computing medium to work out small computational problems requiring quick turnaround.

Aided by systems engineers from the local IBM office, Lockheed developed a program suited to its particular needs that reduced turnaround time from two or three days to a matter of seconds in most cases.

From experience gained with this and other interactive systems, IBM has now generalized and expanded RAX, adding various operational features that allow SYSTEM/360 users to select from a variety of configurations to meet their specific requirements.

Textron's Bell Aerosystems Company, for example, has a RAX installation for its engineering design work at Wheatfield, New York.

"With RAX," says R. E. Carroll, Bell's Director of Data Processing, "an engineer is no longer faced with the problem of queuing for short jobs. Previously, if he had a job that was too complex for a desk calculator, he had to stack it with others and wait as long as two days for the computer output. In the meantime he would turn to other things—in effect, he learned to time-share his work. Now the computer does the time-sharing, not the engineer."

At LTV Aerospace Corp., Dallas based subsidiary of Ling-Temco-Vought, Inc., engineers use RAX to process data from wind tunnel experiments and to solve other aircraft design problems. One typewriter-like terminal, located in the office of a vice president, is used for financial analysis and forecasting. The LTV computer center has installed 18 terminals—nearly all of them miles from the central computer, the most distant is 200 miles away.

Illinois Bell Telephone Company headquartered in Chicago, has strategically located over 30 remote terminals throughout the company for shared-time operations. Over the next two years the number of terminals will more than double. The company uses the RAX system for a variety of jobs, such as telephone transmission and rate studies, analyzing sales performance, and identifying trends in telephone usage.

At the University of Rhode Island, visual display terminals help researchers study problems like fish population interaction. Such studies take into account mortality rates, growth rates, migration habits and other factors, and how the fishing industry and its markets are affected.

At the same time, students and faculty at other terminals elsewhere on the campus are using the central computer to find more efficient ways to transmit information electronically, to analyze urban housing characteristics and to solve other problems.

If you would like to know more about RAX and how it can help you solve your problems faster, write for a copy of the RAX brochure to: Director, Scientific Development, IBM Corporation, Department 805-354, 112 East Post Road, White Plains, New York 10601.

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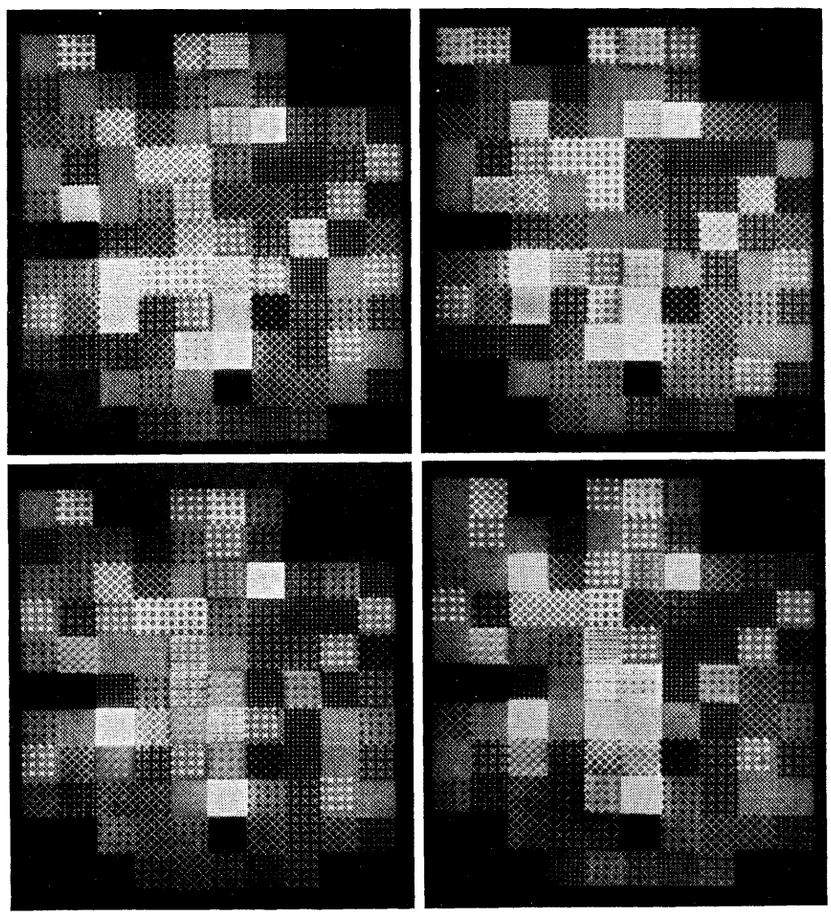
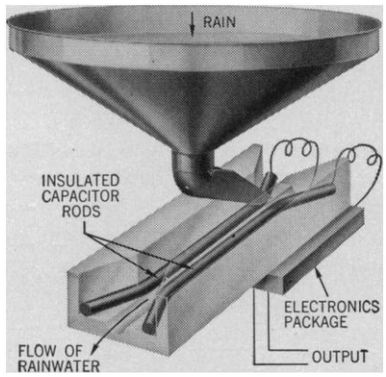
Report from

BELL LABORATORIES

Photos of a rainstorm



Sequence of computer-generated rainfall-rate patterns at 10-second intervals. (Order is upper left and right, then lower left and right.) Small "patches" correspond to geographic positions of 93 rain gauges. Each patch can have one of 48 computer representations of rain rate: dark for no rain, gradually brightening for increasing rainfall. Thus, each of the four frames "maps" a rainstorm in the area, and the sequence is like a motion picture. (Detailed data are recorded on magnetic tape for analysis and correlation with radio transmission characteristics, but the display gives a quick overall view.)

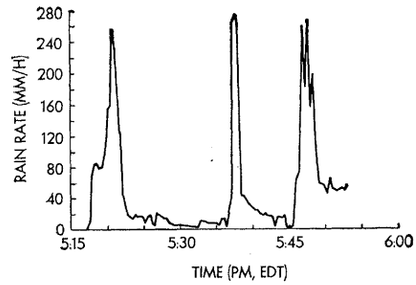


The new rain-rate gauge. Rain collected in funnel, top, flows along 45° incline between two insulated rods . . . the electrodes of a capacitor in an oscillator. Heavier rainfall lowers the oscillator frequency. The gauge can detect one raindrop, yet is accurate within five percent at rates of more than 10 inches per hour.

The pictures at the left represent rain on a 60-square-mile area in east-central New Jersey on November 28, 1966. Actually, they are four photos of a computer-generated display. The brightness of each little "patch" indicates the rainfall rate at each of 93 gauges spaced throughout the area.

We study rainfall because it impairs higher-frequency microwave radio transmission. But no one has had detailed data on its effects. All we had were relatively infrequent rainfall readings from a few gauges near radio paths. We needed—and now have—almost instantaneous readings of rainfall rate from closely spaced gauges over an area.

The result? We have learned a lot about rainfall—for example that heavy, small-area concentrations of rain occur and shift around within a wide-area storm. More important, we can now begin to relate rainfall patterns to specific transmission difficulties. With this information we are improving our strategies for establishing, despite the weather, more reliable radio relay paths at higher microwave frequencies.



Rainfall rate on one gauge during a storm on May 27, 1965. Note rapid response of gauge to changing intensity of rain.

Bell Telephone Laboratories
Research and Development Unit of the Bell System

but a basis for real corrective action will have been obtained. Berkeley did not reach its present position by virtue of preferential treatment by federal agencies. If Ohio (and other states in similar situations) decides to discard her comfortable whipping boys and attempt real improvement, both Ohio and the nation will benefit.

J. DERRAL MULHOLLAND
Post Office Box 631,
La Canada, California 91011

Burgeoning ABM Costs

The antiballistic missile program is about to receive a $5-billion down payment from our government. This initial program may be expanded into an estimated $40 billion project. If so, the dark financial cloud now hanging over other government programs may prove to be merely the beginning of a long night.

I am told that, in foreign policy as in other areas, governmental decisions are made by a process of accommodating diverse and conflicting interests. Scientists, whether pure, applied, or intermediate, are combatants in a long, unrelenting war against poverty, misery, disease, and ignorance. As such, we have a legitimate vested interest in advocating foreign policies which tend to keep expenditures for national defense within reasonable limits.

The scientific community needs to decide where it stands on crucial issues and then to apply pressure in appropriate places. I suggest an unbiased poll of the readers of *Science*, or of some other suitably chosen population, to determine which issues evoke some degree of consensus.

BARUCH S. JACOBSON
Radiation Biology Laboratory,
University of Minnesota Hospitals,
Minneapolis 55455

Essay on Criticism

While sympathizing deeply with McVittie's letter, "Groping through spoken English" (1 Sept., p. 992), I feel we should perhaps bear in mind the well-known words of Alexander Pope, "To 'er' is human. . . ."

DAISY LOMAN
Science Policy Division, UNESCO,
Place de Fontenoy, Paris 7e, France

Who's the new little genius?

Take a look at some really concentrated computational power—the new EAI 580 Analog/Hybrid Computing System.

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It has servo-set pots and all the subsystems and capabilities needed for hybrid computation. It's the first desktop computer with these features.

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When you see the operational advantages of the "little genius," you'll know we weren't kidding.

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West Long Branch, New Jersey

10 November 1967, Volume 158, Number 3802

SCIENCE

Achievement and Management

Last week *Science* described "one of the bitterest critiques a congressional group has ever directed at a federal research agency"—a resumption of the barrage against the Public Health Service, and the National Institutes of Health in particular, that has been fired periodically for the last half dozen years by the congressional subcommittee chaired by Representative L. H. Fountain of North Carolina. Most of the attack is directed against the management of large, general support grants, as distinct from individual project grants: NIH General Research Support grants, Health Sciences Advancement Awards, and a major research-supporting grant to the Sloan-Kettering Institute for Cancer Research. The Public Health Service will have to spend a good deal of time responding to the charges; the report gives Congressman Fountain's committee and staff a feeling of having scored some points against NIH and PHS; it identifies some faults and presents some information not previously made public. But it raises no new policy issues and it beclouds some of the most fundamental problems in the relations of the federal government to its grantees.

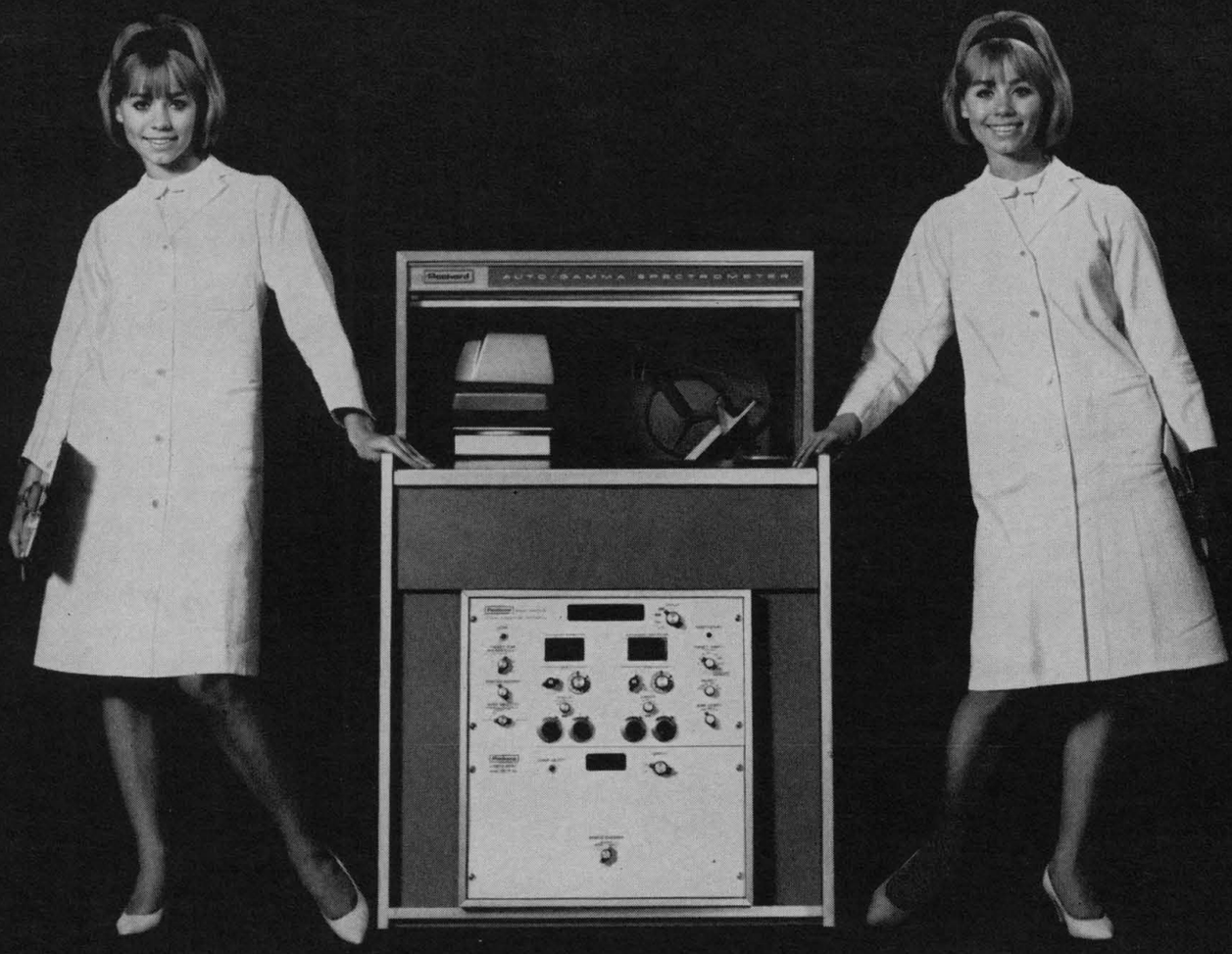
When federal research funds were small, individual project grants sufficed, and they are still the mainstay of the program. However, now that federal funds constitute a substantial fraction of the budgets of many institutions, it has become increasingly desirable that the institution, instead of a group of study panels in Washington, be made responsible for deciding how some considerable portion of its grant funds can be used most constructively. The desirability of grant programs that have this purpose, and this effect, has been agreed upon by Congress, NIH, the National Science Foundation, the National Academy of Sciences, and others. Mismanagement should be corrected wherever it is found, but it would be a disservice to the nation's biomedical program if the current report should bring about a major setback in the further development of programs of large institutional grants.

Fountain likes to quote and criticize a statement by the director of NIH: "the really significant administrative actions designed to make the program efficient and productive are . . . selection of good men and good ideas—and rejection of the inferior. . . . All subsequent administrative actions having to do with the adjustment of budgets, and so forth, are essentially trivial in relation to this basic selection process." *Trivial* was the wrong word. Yet Shannon's emphasis was correct: unless NIH selects good men and good ideas, no subsequent administrative actions can make a grant productive in advancing medical knowledge.

The issue is not one of achievement *or* good management. It is one of putting the two goals, each good in itself, into proper perspective; of understanding that they sometimes require accommodation; and of knowing what the priorities then are. Economy and inventory control are important in military management, but are secondary to military effectiveness. And when there is a conflict between scientific or medical achievement and compliance with all of the niceties of managerial practice, achievement has to take priority. Understanding and resolution of this issue are retarded whenever an investigator, his institution, or a granting agency takes a cavalier attitude toward good management practices. The committee likes to publicize real or imagined examples, but seems not to recognize that it has also set back the search for agreement by placing the secondary goal ahead of the primary one.—DAEL WOLFLE

NEW DUAL CHANNEL AUTO-GAMMA® SPECTROMETER

Now you can get two-channel gamma operation at the single-channel price



Model 5212 is a unique, automatic gamma counting system for either single or double-labeled samples. For two-channel analysis the system is automatically programmed to count each isotope sequentially, using a single scaler. Samples are changed automatically, and the data for each channel is recorded by a digital printer. Low, constant backgrounds are ensured by a patented 100-sample automatic changer. ■ Though it has two-channel capability, Model 5212 is modestly priced . . . costs less than you would expect to pay for Packard's single-channel system. It is an ideal instrument for the laboratory where analysis of double-labeled gamma samples is becoming increasingly important, but volume of counting does not justify purchase of a full two-channel system. ■ Model 5212 is one of Packard's complete line of gamma counting instruments, which range from manual, single-channel instruments to automatic, 400-channel systems for the most sophisticated analysis. Your Packard Sales Engineer can recommend a system exactly suited to your needs. Call him, or write for Bulletin 1064 U to Packard Instrument Company, Inc. 2200 Warrenville Road, Downers Grove, Illinois 60515, or Packard Instrument International S.A., Talstrasse 39, 8001 Zurich, Switzerland.

Packard

light chains are synthesized in a continuous fashion from the amino- to the carboxyl-end without intermediates. This apparently precludes a separate synthesis of the variable and constant portions of the chains (with a later union) under the direction of many genes for the variable part and only one for the constant part. Two important concepts on the control of biosynthesis of antibodies were brought out by G. J. V. Nossal (Royal Melbourne Hospital, Australia) and others; first the concept of the committed cell which makes only one kind of light chain and one kind of heavy chain, and second, that the cell recognizes its own product, in a sense as if it were an antibody. M. Cohn (Salk Institute) in an elegant summary presented a genetic theory for the diversity of immunoglobulins which was contested by the proponents of the Smithies theory of antibody diversity and of other hypotheses of genetic recombination or multiplicity. M. Sela's dramatic arrival from Israel just after the "cease fire" catalyzed the sense of internationality of this gathering of scientists from many lands and diverse backgrounds. The proceedings of this excellent meeting will be published, before the year is out, as the Nobel Symposium III.

FRANK W. PUTNAM
Division of Biological Sciences, Indiana University, Bloomington 47401

Calendar of Events—November

National Meetings

20–21. **Manpower for Oceanography**, education symp., Houston, Tex. (American Soc. for Oceanography, 854 Main Building, Houston 77002)

20–22. American Physics Soc., annual New Orleans, La. (J. O. Kalliokoski, Dept. of Geology, Princeton Univ., Princeton, N.J. 08540)

20–22. American Physics Soc., annual **Fluid Dynamics** mtg., Bethlehem, Pa. (P. S. Klebanoff, Natl. Bureau of Standards, Connecticut Ave. at Van Ness St., NW, Washington, D.C. 20234)

20–22. **Geological** Soc. of America, annual mtg., New Orleans, La. (G. E. Murray, Texas Technical College, Box 4680, Technical Station, Lubbock, Tex., or Miss D. Curtis, Shell Oil Co., Box 60193, New Orleans 70160)

20–22. **Geochemical** Soc., annual mtg., New Orleans, La. (E. C. T. Chao, % U.S. Geological Survey, Washington, D.C.)

20–22. **Mineralogical** Soc. of America, New Orleans, La. (G. Switzer, % U.S. National Museum, Washington, D.C.)

20–22. **Paleontological** Soc. of America,